Development of Lightweight, Radiation- and Damage-Tolerant Micro-trusses

Completed Technology Project (2012 - 2017)

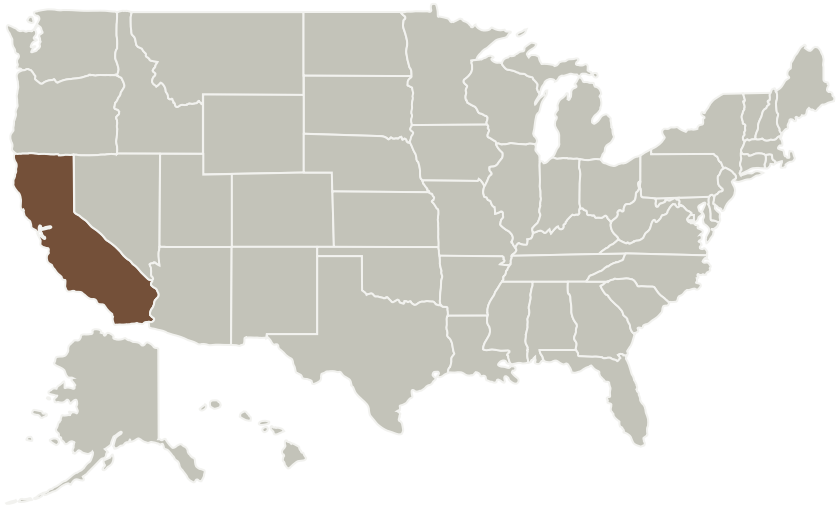
Project Introduction

The proposed work seeks to design and create metallic/metallic glass nanolaminates with optimized nano-scale thicknesses architected into 3-dimensional periodic hollow micro-truss geometries. We will utilize advanced lithography tools to first create these architectures as polymer scaffolds, which will then be conformally coated with a variety of metals/metallic systems. After coating, the internal polymer matrix will be dissolved to reveal a hollow metallic structure, whose design is ultimately hierarchical: from nanometers (wall thickness) to microns (truss member diameters and lengths), to centimeters (fully fabricated truss). This process will combine the 3-dimensional cellular architectures, which offer extremely light weight, with alternating, nanometers-thick metallic/metallic glass nano laminates, which have demonstrated both enhanced radiation tolerance and ductility. Such an out-of-the-box approach to material synthesis promises to harness the beneficial properties offered by nano materials and proliferate them onto larger scales. This, in turn, will enable combining the extremely light weight, radiation immunity, and enhanced stiffness and toughness in a single material.

Anticipated Benefits

Such an out-of-the-box approach to material synthesis promises to harness the beneficial properties offered by nano materials and proliferate them onto larger scales. This, in turn, will enable combining the extremely light weight, radiation immunity, and enhanced stiffness and toughness in a single material.

Primary U.S. Work Locations and Key Partners



Project Image Development of Lightweight, Radiation- and Damage-Tolerant Micro-trusses

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Organizations Performing Work	Role	Type	Location
California Institute of Technology(CalTech)	Lead Organization	Academia	Pasadena, California

Primary U.S. Work Locations
California

Images

11477-1363178741681.jpg
Project Image Development of Lightweight, Radiation- and Damage-Tolerant Micro-trusses
(https://techport.nasa.gov/image/1751)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
California Institute of Technology (CalTech)

Responsible Program:
Space Technology Research Grants

Project Management

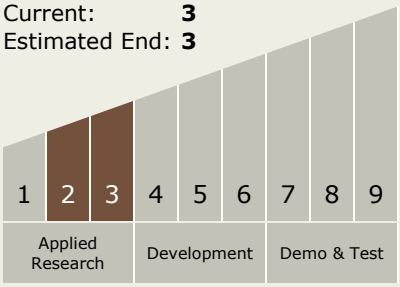
Program Director:
Claudia M Meyer

Program Manager:
Hung D Nguyen

Principal Investigator:
Julia Greer

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Moon, Mars, Foundational Knowledge